PCT/GB 99/03764

The Patent Office

REC'D 24 NOV 1999
WIPO PCT

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

GB99/3764

09/831602

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated 20 October 1999

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

THE PATENT OFFICE
K
11 NOV 1998
RECEIVED BY POST

11 NOV 1998
The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference
Test ~~Diabetic~~ Strips for Small Volumes.

2. Patent application number
(The Patent Office will fill in this part)
9824627.5

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
CAMBRIDGE SENSORS LTD
DOWNHAMS HOUSE
DOWNHAMS LANE, CAMBRIDGE, CB4 1XT

Patents ADP number *(if you know it)*
UK 2668392.

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention
Test ~~Diabetic~~ Strips for Small Volumes

5. Name of your agent *(if you have one)*
- NA -

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*
Cambridge Sensors Ltd.
Downhams House
Downhams Lane, Cambridge, CB4 1XT, UK

Patents ADP number *(if you know it)*

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
- NA -		

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
- NA -	

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES.

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	2
Claim(s)	0
Abstract	1
Drawing(s)	1

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	N4
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature J. McCann Date Nov 7th 1995.

12. Name and daytime telephone number of person to contact in the United Kingdom J. McCann 01223 - 424225
01223 - 420529 (fax)

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

Test Test Strips for Small Volumes

Diabetes is one of the most common endocrine conditions and leads to a requirement for sufferers to monitor their blood glucose level. This is chiefly achieved by use of small blood glucose test strips, which are known in the art. Some of these test strips use electrochemical reactions to carry out the analysis. Typically such reactions will consist of a redox enzyme, a mediator on a working electrode and a separate counter reference electrode.

There is a particular need for test strips that require very small amounts of blood since these are less painful for the patients. The invention described herein described is a test strip for blood glucose in which the sample requirement is very small and effective and efficient reaction kinetics are achieved by the application of the reagent layers in a novel manner.

In particular the enzyme and or co-factor may be applied in a mesh or membrane which is placed over the device such that when the sample is added the enzyme and co-factor are solublised quickly and form an efficient reaction medium that can react with the separate electrodes of the test strip. In this manner the reaction will proceed rapidly and without diffusion barriers. This reaction configuration is particularly indicated in cases where the sample volume is low, the sample is viscous (such as with whole blood) and a rapid reaction is required.

In a typical embodiment of the invention the sensor test strip consist of two electrodes, one of which acts as a working electrode and another which acts as a counter reference electrode. The end of the working electrode that is exposed to the sample has a mediator in intimate contact with it. The reaction chamber consists of these two electrodes with a additional sheet overlaying the electrodes which has been pre-coated with the redox enzyme and any necessary co-factor for that enzyme. In addition the reaction chamber may be completed by the addition of further sheets of material and or the addition of surfactants or cell lysing materials (which may be placed in any one of the overlying aforesaid material sheets). In this manner the active enzyme is not coated onto the conductor which forms the working electrode but sits in the separate layer above it which, in turn, effectively forms the solution phase of the reaction chamber. A drawing of the configuration is enclosed Figure 1)

Other configurations are also possible to one skilled in the art including combinations of one or more of the cofactor, mediator or the enzyme coated onto the overlying mesh or membrane sheets depending upon the reaction kinetics of the various compounds.

In one example of the device a silver chloride, silver reference/counter electrode is located adjacent to a carbon electrode. A mediator for the enzyme cofactor NADH is then prepared and deposited onto the electrode electrode from aqueous solution by pipetting. A further layer containing NAD is then deposited onto the the working electrode.

A monofilament mesh material is then coated with a solution containing glucose dehydrogenase via pipetting, ink jet coating or dip coating and is then placed over the two electrodes to form a reaction chamber. This reaction chamber may be defined further by additional printing, by the use of a top layer to form an edge fill cavity.

In another embodiment of the device the mediator co-factor and the enzyme are all coated onto the working electrode directly and the sheet is such that is capable of filtering the whole

blood such that the active electrode sees a sample which is effectively free of whole blood cells; in this case the haematocrit dependency of the result is substantially reduced.
Preferentially the cell filtering abilities of a selected membrane may be combined with the rapid kinetics of having the some or all of the active elements of the reaction (the enzyme, mediator and the co-factor)in the membrane to produce a highly effective device.

Abstract: Test Test Strips for Small Volumes

The invention provides a method for the realisation of test strips for substances that preferentially require very small samples to be used (down to under 1 micro-litre). This is achieved by the efficient reaction kinetics of test strips in which the reagents are rapidly solublised and in particular having one of the active components of the reaction (enzyme or mediator) entrained in a permeable sheet layer that overlies the working electrode. In some configurations of the device this sheet layer defines a reaction chamber in which efficient reaction kinetics can occur. When combined with lateral turbulent flow, conditions are created which are approaching the conditions of efficient mixing in a stirred reaction chamber. This is particularly useful for small sample volumes, for dealing with viscous fluids such as blood, and for achieving rapid reactions.

Figure 1

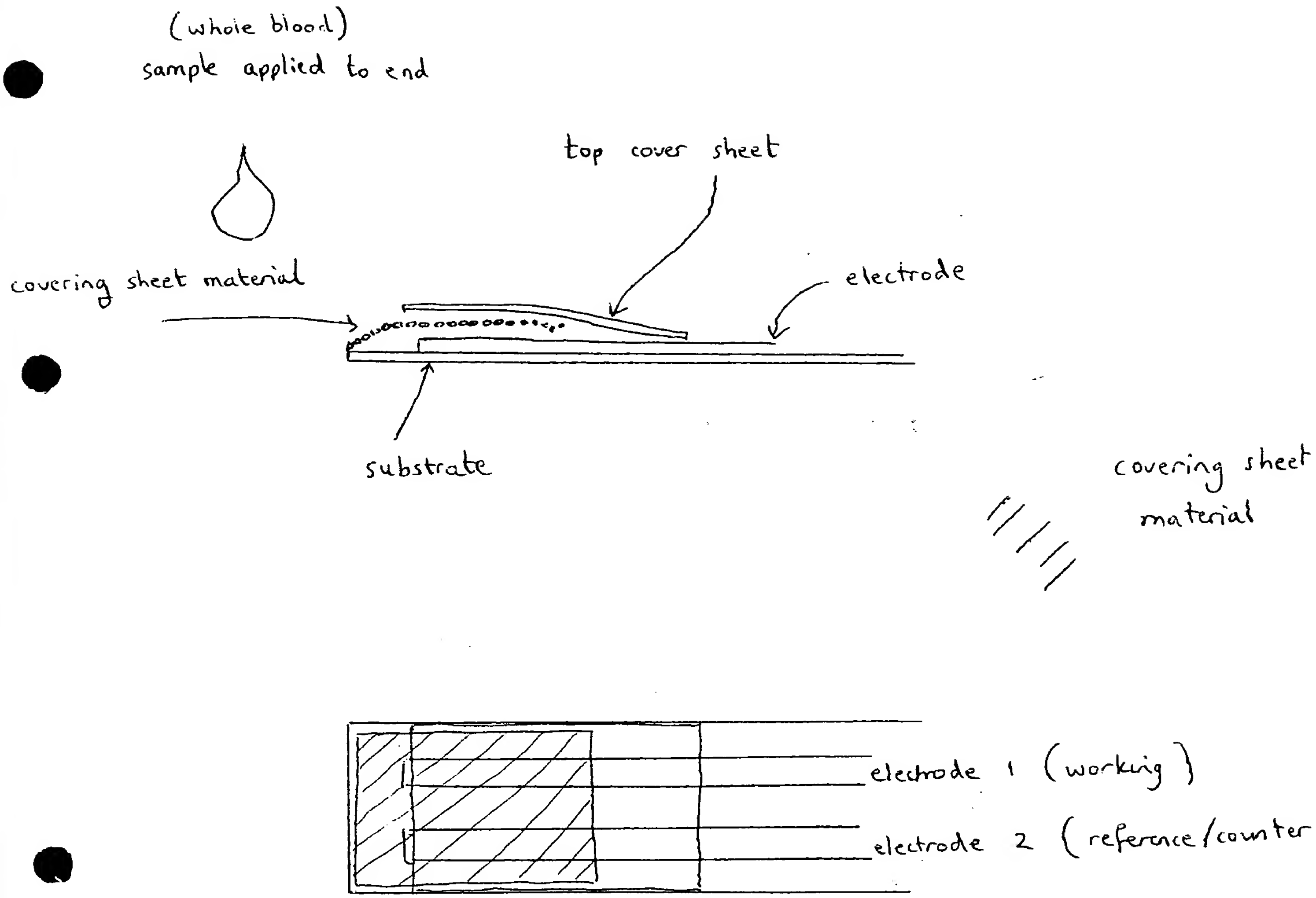
(whole blood)
sample applied to end
top cover sheet
covering sheet material
electrode
substrate
covering sheet
material
electrode 1 (working)
electrode 2 (reference/counter)

Figure 1

9824627.5